# Technology 114//S



Providing transportation technology transfer for lowa's cities and counties

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IOWA STATE UNIVERSITY
Institute for Transportation

# Smart Work Zone Activity App (SWiZAPP) makes work zones work

With the increase in the computing power of portable electronic devices such as smartphones, smart work-zone information can be exchanged simply and cost-effectively.

But that's only one reason why Dr. Yaw Adu-Gyamfi, an assistant professor from the University of Missouri-Columbia, spearheaded a research project aimed to design, develop, and deploy a cross-platform mobile application for collecting and reporting real-time workzone activity information.

Another reason is that the accurate and timely communication of work-zone activities improves work-zone safety by alerting DOT staff, traffic management centers (TMCs), contractors, and the traveling public that a work zone has become active or inactive.

According to Dr. Adu-Gyamfi, such information also facilitates ongoing work-zone safety analysis by enabling the synchronization of work-zone and incident data.

The research, sponsored by the Smart Work Zone Deployment Initiative (SWZDI), was completed in June 2019. Developed using React Native, currently the most popular open-source, mobile application development framework, Dr. Adu-Gyamfi and his team followed a design approach that would allow for future expansion of the app by other agencies.

During the completion of the research, a prototype of the app was built and field-tested at four work-zone sites in Columbia, Missouri. The key metrics to success included geolocation accuracy, user-friendliness, and scalability. In field tests, the accuracy of the app's geolocation module was fairly high overall. SWiZAPP currently supports automatic work-zone geolocation and mapping via on-board global positioning system (GPS) sensors and Google Maps, respectively.

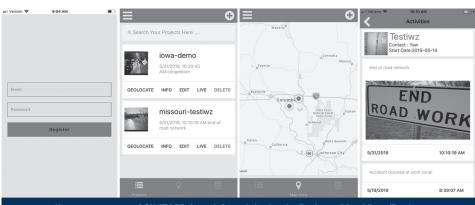
The key components of SWiZAPP include a log-in; Projects, which lists all the work zones added by the user; Map View, which displays the locations of the work zones on a map; and Tracker, which reports all work zone-related activities from all users of SWiZAPP.

App users can post live activities from construction sites by capturing and uploading images, using buttons within the app to indicate traffic conditions and lane activities, and/or using text messaging via the app.

The app also enables users to view both realtime and historical activities of all work zones in SWZDI states, which includes Iowa.

Dr. Adu-Gyamfi notes that due to its scalable design, the app is theoretically capable of managing an unlimited number of construction work zones.

SWiZAPP continued on page 3



Key components of SWiZAPP, from left to right: log-in, Projects, Map View, Tracker

## Acronyms and Abbreviations in Technology News

AASHTO American Association of State Highway and Transportation Officials

APWA American Public Works Association
FHWA Federal Highway Administration
ICEA Iowa County Engineers Association
IHRB Iowa Highway Research Board
InTrans Institute for Transportation (at ISU)
Iowa DOT Iowa Department of Transportation

ISU Iowa State University

LTAP Local Technical Assistance Program MUTCD Manual on Uniform Traffic Control

Devices

NACE National Association of County

Engineers

TRB Transportation Research Board

#### About LTAP

LTAP is a national program of the FHWA. Iowa LTAP, which produces *Technology News*, is financed by the FHWA and the Iowa DOT and administered by the Institute for Transportation at Iowa State University:

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# From the Director: **Acceptance and gratitude**

During the last nine months, there have been two words that have continually come to mind: acceptance and gratitude. I have attempted, with many stumbles no doubt, to let them guide my language and actions both personally and professionally. In March, I developed four guiding action statements for Iowa LTAP. The first statement was and continues to be: "Stick to the Now—Discard what was and might be—focus on what can be." This is easy to say and hard to do, particularly if the situation is not something that is comfortable and changes rapidly. There has been a need to remind ourselves of these guiding statements time and time again. I believe they, along with a revisiting to our purpose/ vision/values, have helped LTAP advance in this continued time of adversity. We know that we have done the best we could with the cards we were dealt.

I believe acceptance of a situation at any particular moment and adjustments as needed are an essential and foundational requirement for leadership, particularly during difficult times. There is a quote from Viktor Frankl (a concentration camp survivor) that I have returned to multiple times. He wrote that "[e] verything can be taken away from a man but one thing—the last of the human freedoms: to choose one's attitude in any given set of circumstances, to choose one's own way." Also, there is a quote that I found more recently, from Admiral James Stockdale (a prisoner of war during the Vietnam War): "You must never confuse faith that you will prevail in the endwhich you can never afford to lose—with the discipline to confront the most brutal facts of your current reality, whatever they may be." This Stockdale Paradox is from the Jim Collins' book, "From Good to Great." My interpretation of these quotes is that they relate to the acceptance of a condition and provide methods on how to deal with it in both thought and action. In other words, how one lives and the choices one makes in relationship to it.

Acceptance is a choice of recognizing and relating to the present moment and to the many variables

that define it for individuals, programs, or agencies. Unfortunately, acceptance is sometimes viewed as a lack of strength, will, or ability or want to fight. A weakness. Acceptance as a choice, however, does not mean a lack of action. One can accept a situation but work within it and/or to change it. In fact, some would argue that acceptance is an essential first step to working with a situation. For any situation, but particularly during those that seem out of our control or out of our reach, I like to go to a quote from Desmond Tutu: "Do your little bit of good where you are; it's those little bits of good put together that overwhelm the world." Something that can be applied at any time.

A related action of assistance, I think, during these difficult weeks and months is a daily practice of gratitude. This is something I started in March and have recently restarted. Yes, I learned about this practice in an LTAP course but also from other references. Each day, with a number of other people, a minute or two is taken to text one or more things for which we are grateful. Big and small, it doesn't matter: "I woke up this morning" or "I had a nice sandwich for lunch." Science has shown that we can change our brains and that humans are wired with a negative bias. The practice of gratitude works to establish a new habit that switches this negative bias into something positive (I believe the science says it takes at least 21 days.). Here are some huge points of gratitude for me: I still have a job I enjoy, a bed to sleep in, and food to eat. You may have noticed I close most of my columns by saying, "with gratitude." This is both a reminder to me and a truth. Iowa LTAP, as always, is here to help with your technical needs, and we remain committed to providing you virtual trainings and information until we can once again get back together. We'll be taking a bit of time off for planning and announcing our training for the beginning of 2021 soon.

Remember the season, enjoy it safely, and with everlasting gratitude,

Keith ■

True Paps

#### SWiZAPP continued from page 1

As with many apps, SWiZAPP could undergo various future updates. The largest, and perhaps most important, is to overcome the obstacle of reliance on internet access. Numerous work zones are in dead zones where internet access is limited and SWiZAPP thus cannot function. In future updates, the app could be designed to store work-zone activity information locally on the phone when there is no internet access and then upload the data when the user regains internet access.

The app is currently available to download for free on Google Play: <a href="https://play.google.com/store/apps/details?id=com.swzapp">https://play.google.com/store/apps/details?id=com.swzapp</a> as well as the Apple Store.

"We designed the app with safety and the user in mind," said Dr. Adu-Gyamfi. "Contractors and work-zone managers could use the app for data collection, tracking, and archiving." For questions about the app, contact Dr. Adu-Gyamfi at <u>adugyamfiy@missouri.edu</u>. For more information, read the full report here: <a href="https://intrans.iastate.edu/research/completed/smart-work-zone-activity-app-swizapp/">https://intrans.iastate.edu/research/completed/smart-work-zone-activity-app-swizapp/</a>.

Article written by Brandy Haenlein, a communication specialist with InTrans. ■

# Snowplow route optimization offers big potential

The Iowa DOT alone is responsible for servicing 24,000 lane miles of roadways during winter road maintenance operations. Optimizing the current routes used by snowplows has the potential to result in significant cost savings, improved safety and mobility, and reduced environmental and societal impacts.

A recent research project at InTrans looked at operations for the Iowa DOT's District 3, located in northwest Iowa, which services about 4,000 lane miles from 20 depots, to solve two optimization problems that could ultimately expand to other districts and local agencies.

"The methods proposed in this study can be used to generate optimized route designs and sector partitions," said Jing Dong, principal investigator for the project and transportation engineer at InTrans. "Inefficiencies in current operations might also be discovered by comparing current routes with optimized routes."

Because the models developed may not represent all local conditions, the routes should be optimized in consultation with a district's maintenance manager to take into consideration those concerns, Dong added.

"Through this work, we identified a few areas where we could reroute plows to reduce driving distance, or improve plow cycle time," said Tina Greenfield, the Iowa DOT road weather information system (RWIS) coordinator.



The lowa DOT services 24,000 lane miles of roadways, including interstates, US highways, and lowa roads during winter road maintenance operations (lowa DOT)

Greenfield added that she expects those changes to be implemented this year.

The project was also noted as a high value research project by AASHTO as part of its Research Advisory Committee's 2020 Sweet Sixteen and Supplemental Categories awards. The work will also be presented at the 2021 TRB in the "High Value Research Supplemental Projects" session.

The snowplow optimization project designed truck routes for single depots under the District 3 current responsibility map and also designed routes for multiple depots with intermediate facilities. The optimization problems were solved as capacitated arc

routing problems (CARPs) using a memetic algorithm (MA) and considering the constraints of road segment service cycle time, heterogeneous vehicle capacities, fleet size, road-vehicle dependency, and work duration.

The results from solving the single-depot optimization problem show a 13.2% reduction in deadhead distance compared to current operations, and the savings could potentially be larger. Deadhead distance is the distance a truck travels while not performing a maintenance service.

For the multiple-depot optimization problem, due to the network structure and current depot locations, the difference between the optimized routes based on a multiple-depot configuration and those based on a single-depot configuration is insignificant.

Though the project focused on snowplows, the route optimization could apply to any vehicles that perform winter maintenance activities, including snow and ice removal as well as the spreading of materials like salt and sand to increase friction and provide anti-icing and de-icing treatments.

More information about the project, including the final report and technology transfer summary, is available here: <a href="https://intrans.iastate.edu/research/completed/">https://intrans.iastate.edu/research/completed/</a> iowa-dot-office-of-maintenance-snowplow-optimization/.

#### **Iowa LTAP Mission**

To foster a safe, efficient, and environmentally sound transportation system by improving skills and knowledge of local transportation providers through training, technical assistance, and technology transfer, thus improving the quality of life for Iowans.

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# **In Brief: Lasting LTAP Impacts** Worker Safety Training Resources How-To

The Iowa LTAP is continually dedicated to providing as many training opportunities as possible during this time.

Located under the Resources tab on the Iowa LTAP website, you can currently find a series of 23 safety training topics curated to specifically assist local public works and county secondary roads departments with their safety training for employees.

When we say that these Worker Safety Training Resources are "curated," we mean that each training can be made applicable to you. Our first step in our Instructions is to print the applicable subpart of the standard and highlight the portion that applies to your organization.

"And train to that—just the things that apply to you and your organization," said Paul Albritton, the Iowa LTAP Technical Training Coordinator.

For example, the Bloodborne Pathogens training is a large standard, and some areas don't necessary apply to the work done by local public works employees. So, to get the most out of any of the trainings:

- 1. Highlight the applicable portion of the standard
- 2. Preview the training video (no logins required)
- Review instructor materials and check for any OSHA Training Requirements
- 4. Print and use the OSHA Fact Sheets and/ or Tailgate Talks
- 5. Present just those materials and the video during your Safety Meeting
- 6. Collect sign-in sheets, document the meeting and what subjects were covered

All of the trainings have the same basic "look":

- A Summary of the standard, which includes a description of tasks performed by the "competent person" (i.e., individual designated by the employer who is capable of identifying existing and predicable hazards in the surroundings or working conditions)
- Some specifics about the individual training (such as soil classification categories for the **Excavation Training**)
- Other important information
- Links (at the bottom of the training page) to the training requirements with each of standard's appendices (subparts) already separated out for ease-of-use

"It should be noted that the training videos are located off-site, and if you are the one doing the training, preview the video first to highlight the points you want to emphasize," said Albritton. The Preview Video option is a low-quality video and should not be used during trainings. Instead, use the English or Spanish high-quality video option, located directly below the Preview button.

Check out the current training programs: https://iowaltap.iastate.edu/2020-safetyresources-main-face/. The Iowa LTAP asks that you provide basic information initially during login to use these resources, in an effort to track who is using the materials.

For questions or more specific information about the Worker Safety Training Resources, contact Paul Albritton.

Article written by Brandy Haenlein, a communication specialist with InTrans. ■

# New spreadsheet tool helps determine optimum time for equipment replacement

The ink is just dry on local budgets, but it's never too early start planning for the next year.

Thankfully, there's a new spreadsheet tool that will help local agencies plan for their equipment needs with more certainty. The Equipment Life-Cycle Cost Analysis Tool (E-L-T) allows users to assess the optimum time to replace their trucks and motor graders considering both purchasing and leasing options.

"We found less than a third of local agencies in lowa have a replacement process, and many that do have a process use a general standard of periodic replacement, which is not an efficient method," said Jennifer Shane, a principal investigator on the project that developed the tool. "This tool will give Iowa counties and cities an enhanced ability to make defensible equipment management decisions."

The tool is also designed to allow users to try different scenarios to better understand the

sensitivity of their assumptions and thus better explain their decisions during budget seasons. The tool has two modules, one that provides a specific year for replacement based on the user inputs and one that runs several models based on a range of inputs to give a range of replacement options.

All results are displayed graphically to better gauge the optimum replacement time.

"We know that counties spend about half their budgets on maintenance, and equipment is about 27 percent of maintenance at any given time," said Shane. "We wanted to develop something county engineers can tailor to their needs and use to present to their boards on their equipment needs."

The research project included a couple of surveys of counties to get a better idea of what equipment data is currently collected and to better understand the replacement process. After determining that counties collected little

data, the project also developed a recordkeeping template as well so that counties can better use the tool in the future by providing their real-world data.

"A simple rule for replacing equipment is when the annual costs for maintenance and operating the equipment exceed the trade-in value, it's time to replace the equipment," Shane said. "Thus, keeping track of those costs and trade in-values are essential pieces of data in equipment management."

While the project focused on Iowa counties, and came out of a discussion at a County Engineers Research Focus Group meeting, the tool will also work for other local agencies, including Iowa cities.

The spreadsheet tool, associated user's manual, and the full research report are available here: <a href="https://intrans.iastate.edu/research/completed/optimizing-maintenance-equipment-life-cycle-for-local-agencies/">https://intrans.iastate.edu/research/completed/optimizing-maintenance-equipment-life-cycle-for-local-agencies/</a>.

"A simple rule for replacing equipment is when the annual costs for maintenance and operating the equipment exceed the trade-in value, it's time to replace the equipment."

—Jennifer Shane, principal investigator on tool development project

# FHWA announces EDC-6 initiatives

Every Day Counts (EDC) is a state-based model that identifies and rapidly deploys proven, yet underutilized innovations to shorten the project delivery process, enhance roadway safety, reduce traffic congestion, and integrate automation.

The EDC-6 Summit was conducted virtually in December and included over 3,000 attendees from state DOTs, local agencies, federal land management agencies, tribes and industry—to encourage creative thinking, and celebrate a shared vision for new opportunities. In this cycle, the seven initiatives feature strategies to increase engagement with people, new applications of products to preserve and repair our infrastructure, and improve processes to

save time on project delivery and incident management.

The presentations, factsheets, videos, EDC virtual booths, and pdfs of innovations developed by the National State Transportation Innovation Council (STIC) Network are available on-demand to all registered participants through December 2021. Please register at the following link: <a href="https://www.labroots.com/ms/virtual-event/fhwa-everyday-counts-6-virtual-summit">https://www.labroots.com/ms/virtual-event/fhwa-everyday-counts-6-virtual-summit</a>. Not sure which EDC-6 breakout session to attend? FHWA created short videos to preview each session here: <a href="https://www.youtube.com/playlist?list=PL5">https://www.youtube.com/playlist?list=PL5</a> sm9g9d4T3VWC5gACfMoie E-WnHmqF.

Additional information is available on the FHWA website at <a href="https://www.fhwa.dot.gov/innovation/everydaycounts/edc">https://www.fhwa.dot.gov/innovation/everydaycounts/edc</a> 6/.

The specific initiatives are as follows:

- Crowdsourcing for Advancing Operations
- e-Ticketing and Digital As-Builts
- Next-Generation TIM: Integrating Technology, Data, and Training
- Strategic Workforce Development
- Targeted Overlay Pavement Solutions (TOPS)
- UHPC for Bridge Preservation and Repair
- Virtual Public Involvement (VPI) ■

# Stress management and resiliency resources available

Stress is often a reality of modern life, but it's taken on a whole new meaning in 2020.

Recognizing that we were entering a new world with the arrival of the COVID-19 pandemic this past spring, Iowa LTAP moved swiftly to offer resources to manage stress and build resiliency. However, as the pandemic enters its 9th month and the holidays approach, the lessons from those webinars may be newly relevant or a good refresher.

That's why Iowa LTAP recently invited Dr. Diane S. Rohlman, Professor and Endowed Chair in Rural Safety and Health at the University of Iowa, to lead a webinar on suicide prevention. Her presentation was followed by the Stress Management Basics course.

For those who missed the presentation, they can still watch it here: <a href="https://iowaltap.iastate.edu/you-ok-suicide-prevention-webinar/">https://iowaltap.iastate.edu/you-ok-suicide-prevention-webinar/</a>.

In addition, the webinar on remaining resilient—originally held in mid-May and led by guest speaker Krisdeena Jansen—remains pertinent and is also available along with all of Iowa LTAP's webinar offerings at <a href="https://iowaltap.iastate.edu/webinars/">https://iowaltap.iastate.edu/webinars/</a>.

"The most successful way that we can start to overcome the stress that we have is really just identifying and acknowledging that we are stressed and that we don't just have to ignore it," Jansen said.

The webinar offers tips not only for recognizing stressors but tricks for managing stress and uncertainty in healthy ways. Likewise, the stress management basics course offers a number of ways to be mindful and cope with stress.

"It's all in how you look at things, and how much you let them get to you," said Iowa LTAP Safety Circuit Rider David Veneziano, who led The Stress Management Basics course.

Additional resources on managing stress are available from the Centers for Disease Control and Prevention at: <a href="https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/stress-coping/index.html">https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/stress-coping/index.html</a>.

"The most successful way that we can start to overcome the stress that we have is really just identifying and acknowledging that we are stressed and that we don't just have to ignore it."

-Krisdeena Jansen, guest speaker at Iowa LTAP-sponsored webinar

# Radar recording equipment available for loan

Need a non-invasive way to automatically collect traffic data, such as vehicle speeds, lengths, gaps, and volumes? The LTAP Equipment Loan Program can help with that.

Iowa LTAP recently added two JAMAR Radar Recorders to the Equipment Loan Program. These devices are now available to lend to agencies free of charge.

These units are battery powered and can run for approximately seven days before needing to be recharged. Each unit is installed by attaching it to a roadside pole (typically utility) at a height that is approximately level with the traffic stream. They can collect bi-directional and multilane data. Data is stored internally in a proprietary format and downloadable to a computer using the vendor's software. That data can also be exported to Excel format for further analysis.



As with all available equipment, lending is on a first come, first served basis for a two-week to one-month period. The goal of the program is to offer local agencies the use of various devices that can help assist in managing roadway signing and infrastructure safety. If interested, fill out the form here to request a radar recorder: <a href="https://iowaltap.iastate.edu/radar-recorders/">https://iowaltap.iastate.edu/radar-recorders/</a>.

LTAP continues to expand its Equipment Loan Program. Within the past year, it has added speed feedback signs and a set of equipment that aids in testing wood pilings and structural members for decay. It also offers a sign retroreflectometer and digital ball banks for local agency use.

To request any of the items or learn more about their uses, visit <a href="https://iowaltap.iastate.edu/equipment-loan-program/">https://iowaltap.iastate.edu/equipment-loan-program/</a>. For questions or more information, contact David Veneziano, LTAP Safety Circuit Rider.

Article written by Brandy Haenlein, a communication specialist with InTrans. ■

[Information current as of December 21, 2020] Due to the ongoing COVID-19 pandemic, many of our usual events have moved to an online format as staff consider how and when to safely return to typical in-person trainings, workshops, and conferences. The fluid nature of our current moment means that the virtual events have not been scheduled as far in advance as is typical for this quarterly format, and the events listed below as scheduled to be in person are subject to change.

Events that staff may consider scheduling in person may also offer a registration of interest to gauge potential participants' willingness to hold events in a variety of formats. Anyone who registers for such events will be notified as the situation changes and will be given guidance as needed.

For the most up-to-date information, please check regularly at <a href="https://iowaltap.iastate.edu/events/">https://iowaltap.iastate.edu/events/</a> and consider subscribing to our mail list from the Iowa LTAP home page at <a href="https://iowaltap.iastate.edu/">https://iowaltap.iastate.edu/</a> to get regular email updates.

Date	Event Name	Location	Contact
January 2021			
15	Evaluating Statewide Bicycle and Pedestrian Safety Risk Through Systemic Analysis	Webinar (12:00 p.m. CT)	Keith Knapp
22	Top 20 in Rural Bridge Replacement and Repair Innovations	Webinar (12:00 p.m. CT)	Keith Knapp
29	Safety Countermeasures for Unpaved and Gravel Roads	Webinar (12:00 p.m. CT)	Keith Knapp
February 2021			
5	Capabilities and Advantages of Steel Buried Bridges (Part 1 – Short Span Steel)	Webinar (12:00 p.m. CT)	Keith Knapp
12	SWiZAPP – Smart Work Zone Activity App	Webinar (12:00 p.m. CT)	Keith Knapp
19	Planning & Design Accommodation for Oversize & Overweight Freight in Work Zones	Webinar (12:00 p.m. CT)	Keith Knapp
22–26	Iowa Work Zone Safety Workshops (Virtual)	Webinar (TBA)	Paul Albritton
26	Composite Press-Brake Formed Modular Steel Tub Girders for County Bridges: Development, Experimental Validation, and Case Studies (Part 2 – Short Span Steel)	Webinar (12:00 p.m. CT)	Keith Knapp

#### **Contact information**

Keith Knapp, 515-294-8817, kknapp@iastate.edu Paul Albritton, 515-294-1231, palbritt@iastate.edu ■

## **Event details and online registration**

Watch for details and online registration information, by specific dates and events, on the Iowa LTAP Workshops page, <a href="mailto:iowaltap.iastate.edu/workshops/">iowaltap.iastate.edu/workshops/</a>.

# **Welcome Shari Butterfield to LTAP**

Chances are good that regular LTAP clients have seen Shari Butterfield's name on one of several webinars since this summer, but it's unlikely that they've had the opportunity to meet LTAP's administrative event coordinator in person yet.

Prior to the pandemic, the event coordinator often welcomed attendees at the door, got them signed in, and provided them the appropriate handouts. Now, not so much.

Butterfield began working with Iowa LTAP on June 29, 2020 and was thrown into a unique office environment. The strangeness began, in fact, even before she started.

"Being interviewed over Zoom was a first and very unique experience," Butterfield said. "I still haven't met everyone—live or online—but everyone has been very friendly and helpful as I navigate this new position." Butterfield, who grew up in Iowa City and lived most of her adult life in eastern Iowa, said that her work at LTAP combines all of her previous experience into one position. Even in more typical years, the administrative event coordinator has a wide variety of day-to-day tasks.

Her current work includes scheduling and hosting the weekly webinars, planning and coordinating the annual Streets and Roads Workshop and Conference, creating and sending certificates for all LTAP events, and assisting Iowa LTAP staff, along with many other projects. She's also working on longer-term tasks that include the LTAP Communications Plan, a redesign of the Roads Scholar Program, and a reorganization of LTAP's library.

"There's a wide range of tasks, but I like the variety," Butterfield said.



# Contact Reach out to Shari Butterfield with any LTAP event questions or just drop a line to welcome her to Iowa LTAP at (515) 294-1292 or at sharib@iastate.edu.

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